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Photo Copier Maintenance Expert System V.01 Using SL5 Object Language

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Abstract: *The aim of this study was to introduce the design of an expert system which was able to diagnoses photocopier problems specially "the copy too light halftone area only". Our expert system was not meant to replace the human maintenance technician; but using such system may be useful in cases like overcoming the problems of the shortage in human technicians. and accuracy and speed in fixing problems. So this system can be used to help the maintenance technician in their work. This expert system was designed and implemented using SL5 Object language. Our expert system was initially evaluated with exiting classical test cases. The result of the evaluation was accurate and promising.*

Keywords: Expert systems, halftone, maintenance.

1. INTRODUCTION

One of the most useful -- and most expensive -- pieces of equipment you might purchase for your office is a photocopier. The larger, more professional versions can run thousands of dollars, and repair and maintenance can also become costly. To avoid unnecessary calls to your manufacturer's service department for repairs, you can follow some simple maintenance techniques to keep your copier clean and functioning, saving your business some money and saving you some headaches.

Figure 1: Photocopier and technicians

So in this paper we presented an Expert System for photocopier to help the photocopier owner to repair it in a few minutes to save time and money, without calling any maintenance professional or technician. And we focus here on the problem of the "copy too light halftone area only"[1-3].

2. LITERATURE REVIEW

There is a lot of Expert System that were designed and implemented in many fields such as health for diagnosing diseases such as Eye, Endocrine, skin, foot, shoulder, and other types of disease [4-12,14-34]. But there is no specialized expert system for diagnosis of Photocopier problems available free.

3. KNOWLEDGE ACQUISITION

Basic information about Photo Copier Maintenance problems, symptoms and treatment where collected from experts (Technicians) and books. Knowledge elicitation was performed through interviews with the human experts.

4. KNOWLEDGE REPRESENTATION

The environment of the system may affect its reliability. The use of some Expert System programming languages makes the system limited in specific features. The Expert System language chosen must be rule based, portable, and use SL5 Object rules. SL5 Object (Simpler Level Five Object) was developed by Professor Samy Abu Naser [13]. SL5 Object is a rule based expert system language that is suitable for our expert system. SL5 Object is a productive development and delivery expert system tool which provides a complete environment for the construction of rule and/or object oriented based expert systems. This class contains the methods to set up and control the SL5 Object environment. It is free for educational use. All of the rule sets used in the System are loosely based on Knowledge.prl. The Photocopier Maintenance Expert System V.01 decision Tree is shown in Figure 2.

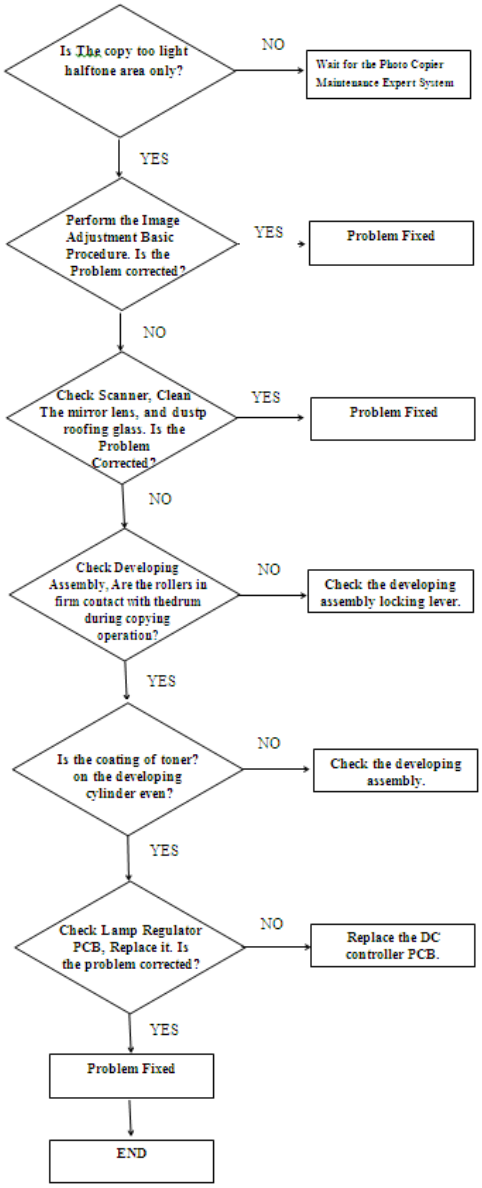

Figure 2: Photocopier Maintenance Expert System V.01Tree

5. EXPERT SYSTEM USER INTERFACE

The structure of the system is shown in Figure 3. When the expert system starts a stating screen is shown and the patient is supposed to read the instructions (See Figure 4). Communication between the user and the expert system is done through the user

interface in English Language which was implemented to be easy for the regular end user using Yes or No questions (See Figure 5 and 6). The Conclusion of the expert system is shown in figure 7. The user interface does not require much typing.

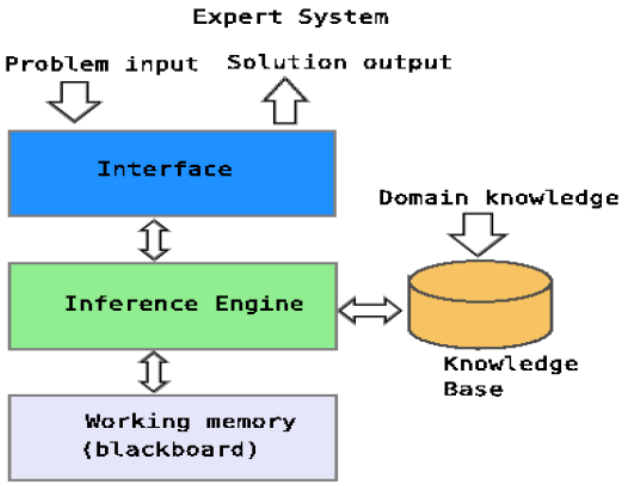

Figure 3: Main component of the Expert System

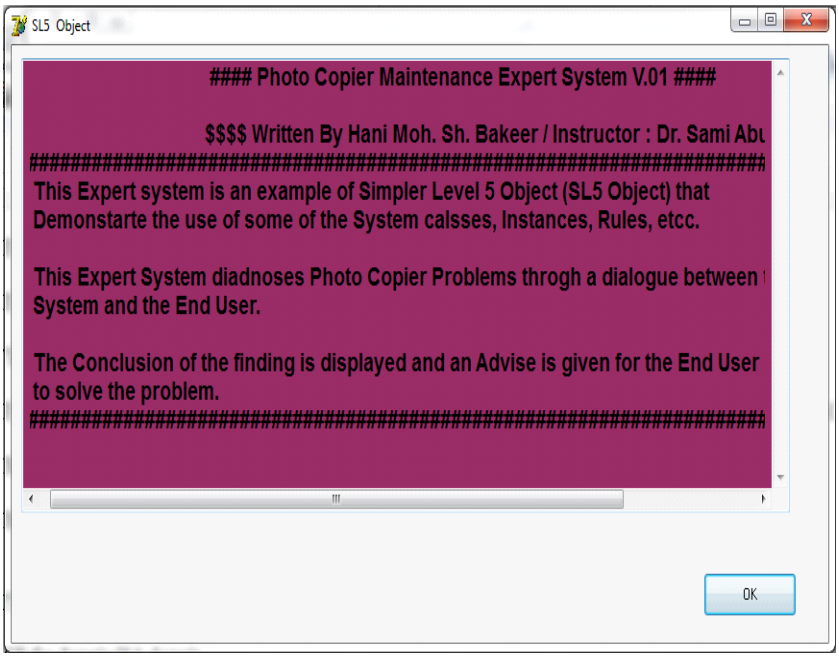

Figure 4: starting screen of the expert system

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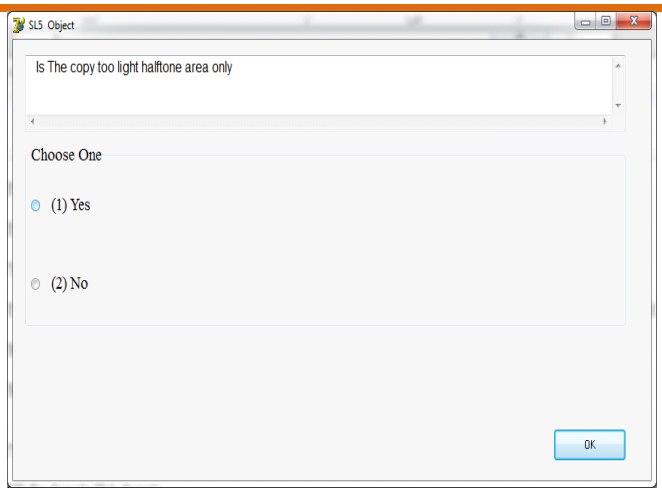

Figure 5: Dialogue between the user and the expert system

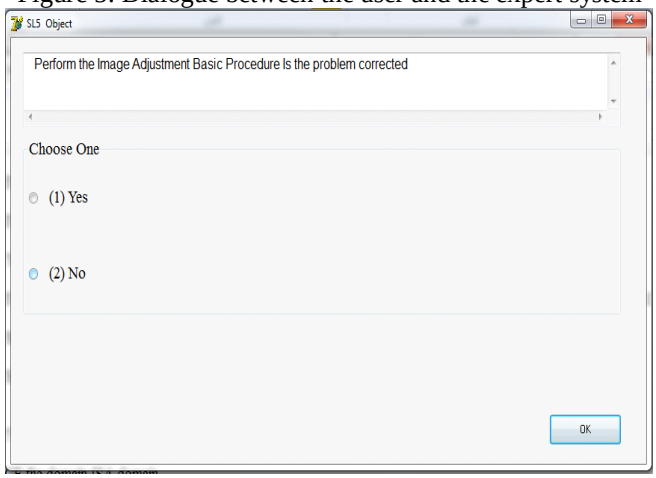

Figure 6: Dialogue between the user and the expert system

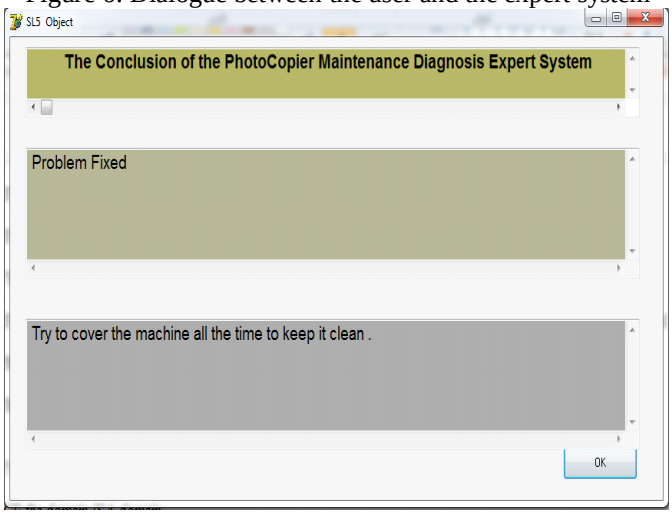

Figure 7: The conclusion of the expert system

6. SYSTEM EVALUATION

In a preliminary evaluation of the expert system, a few classical test cases were used to test the expert system and the result of the system was accurate when compared with the result of service department for repairs; furthermore, some users having the same photocopier problems tried this expert system, in order to evaluate it and they were surprised by the accuracy of diagnosis and fixing problems and maintenance of the photocopier.

7. CONCLUSION AND FUTURE WORK

In this study, we have presented a maintenance and repair help Expert System for the photocopier. This Expert System is called Version 0.1 because we Looking forward to Develop this version to a new version V0.2, because this version includes only some problems on the " copy too light halftone area only". The system can be improved to include more problems and errors. We have tested the system by using the same problems and errors and checked if the system's result in agreement with the manufacturer's service department for repairs.

This expert system is considered to be a base of future ones; additional problems and errors are planned to be added and to make it more accessible to users from anywhere and anytime.

8. EXPERT SYSTEM SOURCE CODE

```
ATTRIBUTE Is The copy too light halftone area only?   COMPOUND
        Yes, No
ATTRIBUTE Perform the Image Adjustment Basic Procedure Is the problem corrected?   COMPOUND
        Yes, No
ATTRIBUTE Check Scanner Clean the mirror lens  and dustproofing glass Is the problem corrected? COMPOUND
        Yes, No
ATTRIBUTE Check Developing Assembly Are the rollers in firm contact with the drum during copying operation?
COMPOUND
        Yes, No
ATTRIBUTE Is the coating of toner on the developing cylinder even?   COMPOUND
        Yes, No
ATTRIBUTE Check Lamp Regulator PCB Replace it  Is the problem corrected?   COMPOUND
        Yes, No
ATTRIBUTE start SIMPLE

INSTANCE the domain ISA domain
  WITH start := TRUE

INSTANCE the application ISA application
 WITH title display := introduction
 WITH conclusion display :=  Conc
 WITH numeric precision := 8
 WITH simple query text := "Is it true that:
  *
is
  *"
  WITH numeric query text := "What is(are):
  *
of
  *"
  WITH string query text := "What is(are):
  *
of
  *"
  WITH time query text := "What is(are):
  *
of
  *"
  WITH interval query text := "What is(are):
  *
of
  *"
  WITH compound query text := "
  *
of
```

```
  *"
  WITH multicompound query text := "What is(are):
  *
of
  *"
INSTANCE introduction ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1 ] := textbox 1

INSTANCE textbox 1 ISA textbox
  WITH location := 10,10,800,350
  WITH pen color := 0,0,0
  WITH fill color := 150,300,100
  WITH justify IS left
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text :="
                              #### Photo Copier Maintenance Expert System V.01 ####
$$$ $$$ Written By Hani Moh. Sh. Bakeer / Instructor : Dr. Samy Abu Naser
##########################################################################
# This Expert system is an example of Simpler Level 5 Object (SL5 Object) that
# Demonstrate the use of some of the System classes, Instances, Rules, etc.
#
# This Expert System diagnoses Photo Copier Problems through a dialogue between the
# System and the End User.
#
# The Conclusion of the finding is displayed and an Advise is given for the End User
# to solve the problem.
########################################################################## "


INSTANCE Conc ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1] := title textbox
  WITH items [2 ] := problem textbox
  WITH items [3 ] := advise textbox

INSTANCE title textbox ISA textbox
  WITH location := 20,10,800,70
  WITH pen color := 0,0,0
  WITH fill color := 180,180,100
  WITH justify IS center
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text := " The Conclusion of the PhotoCopier Maintenance Diagnosis Expert System"

INSTANCE problem textbox ISA textbox
  WITH location := 20,110,800,130
  WITH pen color := 0,0,0
  WITH fill color := 180,180,150
  WITH justify IS left
  WITH font := "Arial"
```

```
  WITH font size := 14
   WITH text :=" --====--"
INSTANCE advise textbox ISA textbox
  WITH location := 20,280,800,130
  WITH pen color := 0,0,0
  WITH fill color := 170,170,170
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 14
  WITH text :=" --====--"

RULE R0
IF start
THEN ASK Is The copy  too light halftone area only  ?

RULE R1
IF Is The copy  too light halftone area only  ?  IS Yes
THEN ASK Perform the Image Adjustment Basic  Procedure Is the  problem corrected?

RULE R1a
IF Is The copy  too light halftone area only  ?  IS No
THEN text OF problem textbox  := "So the Problem is not in the halftone area . "
AND text OF advise textbox := "Wait for the Photo Copier Maintenance Expert System V.02 "

RULE R2
IF Perform the Image Adjustment Basic  Procedure Is the  problem corrected? IS Yes
THEN text OF problem textbox  := "Problem Fixed "
AND text OF advise textbox := "Try to cover the machine all the time to keep it clean ."

RULE R2a
IF Perform the Image Adjustment Basic  Procedure Is the  problem corrected? IS No
THEN ASK Check Scanner Clean the mirror lens and dustproofing glass Is the problem corrected?

RULE R3
IF Check Scanner Clean the mirror lens and dustproofing glass Is the problem corrected? IS Yes
THEN text OF problem textbox  := "Problem Fixed "

RULE R3a
IF Check Scanner Clean the mirror lens and dustproofing glass Is the problem corrected? IS No
THEN ASK Check Developing Assembly Are the rollers in firm contact with the drum during copying operation?

RULE R4
IF Check Developing Assembly Are the rollers in firm contact with the drum during copying operation? IS Yes
THEN ASK Is the coating of toner on the developing  cylinder even?

RULE R4a
IF Check Developing Assembly Are the rollers in firm contact with the drum during copying operation? IS No
THEN text OF problem textbox  := "Check the developing assembly locking lever "

RULE R5
IF Is the coating of toner on the developing  cylinder even? IS Yes
THEN ASK Check Lamp Regulator PCB Replace it  Is the problem corrected?

RULE R5a
IF Is the coating of toner on the developing  cylinder even? IS No
THEN text OF problem textbox  := "Check the developing assembly "
```

RULE R6
IF Check Lamp Regulator PCB Replace it Is the problem corrected? IS Yes
THEN text OF problem textbox := "Problem Fixed "

RULE R6a
IF Check Lamp Regulator PCB Replace it Is the problem corrected? IS No
THEN text OF problem textbox := "Replace the DC controller PCB. "
END

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